

## ABSTRACT

An integrated optical multiplexer and/or demultiplexer is provided for on-chip optical interconnection between electronic components on an integrated circuit chip and between chips, and for high density telecommunications. The multiplexer and/or demultiplexer includes an integrated circuit substrate formed with an array of photo detectors (for the demultiplexer) or photo emitters (for the multiplexer). Conditioning electronics is formed on the substrate and is coupled to the photo elements for conditioning electronic data for optical transmission in the case of the multiplexer or for conditioning optical signals into electronic data in the case of the demultiplexer. A first layer of optically transparent material is formed on the substrate overlying the detectors and/or emitters and a second layer of optically transparent material is formed on the first layer and functions as an optical waveguide. A binary blazed grating is formed at the interface of the first and second layers of optically transparent material. In use, discrete wavelength optical signals are modulated with data and emitted by the photo emitters. The discrete wavelengths are intercepted by the binary blazed grating overlying the emitters and multiplexed into a polychromatic beam for transmission through the waveguide. At the demultiplexer, the discrete wavelengths are separated by the binary blazed grating and directed to corresponding ones of the photo detectors. The conditioning electronics coupled to the photo detectors receives the output of the photo detectors, demodulates the output to extract the data, and formats the data for communication with electronic components on the integrated circuit.